

FORM PTO-1390

U.S. Department of Commerce Patent and Trademark Office

Attorney's Docket No.

2036-170

U.S. Application No. (if known, see 37 CFR 1.5)

09/424210

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

INTERNATIONAL APPLICATION NO. PCT/NO98/00182	INTERNATIONAL FILING DATE June 12, 1998	PRIORITY DATE CLAIMED June 16, 1997
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TITLE OF INVENTION
METHOD AND APPARATUS FOR MEASURING STRUCTURES IN A FINGERPRINT

APPLICANT(S) FOR DO/EO/US
Jon TSCHUDI

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. This is a FIRST submission of items concerning a filing under 35 U.S.C. 371
2. This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. has been transmitted by the International Bureau.
 - c. is not required, as the application was filed in the United States Receiving Office (RO/US)
6. A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. have been transmitted by the International Bureau.
 - c. have not been made; however, the time limit for making such amendments has NOT expired.
 - d. have not been made and will not be made.
8. A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

ITEMS 11. TO 16. below concern other document(s) or information included:

11. An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. A FIRST preliminary amendment.
 A SECOND or SUBSEQUENT preliminary amendment.
14. A substitute specification.
15. A change of power of attorney and/or address letter.
16. Other items or information: PCT/RO/101 (4 sheets), Copy of WO 98/58342 published Dec. 23, 1998.
PCT/ISA/210, Amended Claims (1-14), PCT/IPEA/409 (4 sheets), PCT/IB/304 (1 sheet).
PCT/IB/308 (2 sheets)

U.S. APPLICATION NO. (if known) (37 CFR 1.10)	INTERNATIONAL APPLICATION NO.	ATTORNEY DOCKET NO.										
09/424210	PCT/NO98/00182	2036-170										
<p>17. [X] The following fees are submitted:</p> <p>Basic National Fee (37 CFR 1.492)(a)(1)-(5):</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 75%;">Search Report has been prepared by the EPO or JPO</td> <td style="width: 25%; text-align: right;">\$ 840.00</td> </tr> <tr> <td>International preliminary examination fee paid to USPTO (37 CFR 1.482)</td> <td style="text-align: right;">\$ 670.00</td> </tr> <tr> <td>No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))</td> <td style="text-align: right;">\$ 760.00</td> </tr> <tr> <td>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO</td> <td style="text-align: right;">\$ 970.00</td> </tr> <tr> <td>International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)</td> <td style="text-align: right;">\$ 96.00</td> </tr> </table>		Search Report has been prepared by the EPO or JPO	\$ 840.00	International preliminary examination fee paid to USPTO (37 CFR 1.482)	\$ 670.00	No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	\$ 760.00	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO	\$ 970.00	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	\$ 96.00	<u>CALCULATIONS</u> <u>PTO USE ONLY</u> ENTER APPROPRIATE BASIC FEE AMOUNT = \$ 840.00
Search Report has been prepared by the EPO or JPO	\$ 840.00											
International preliminary examination fee paid to USPTO (37 CFR 1.482)	\$ 670.00											
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	\$ 760.00											
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO	\$ 970.00											
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	\$ 96.00											
<p>Surcharge of \$130.00 for furnishing the oath or declaration later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).</p>		\$										
Claims	Number Filed	Number Extra	Rate									
Total Claims	14 -20 =	0	X \$18.00	\$								
Independent Claims	2 - 3 =	0	X \$78.00	\$								
Multiple dependent claim(s) (if applicable)			+ \$260.00	\$								
TOTAL OF ABOVE CALCULATIONS =				\$								
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				\$								
SUBTOTAL =				\$								
Processing fee of \$130.00 for furnishing the English translation later [] 20 [] 30 than months from the earliest claimed priority date (37 CFR 1.492(f)).				+	\$							
TOTAL NATIONAL FEE =				\$								
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				+	\$40.00							
TOTAL FEES ENCLOSED =				\$								
				Amount to be refunded	\$880.00							
				charged	\$							
<p>a. [X] A check in the amount of <u>\$ 880.00</u> to cover the above fees is enclosed.</p> <p>b. [] Please charge my Deposit Account No. 02-2135 in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-2135. A duplicate copy of this sheet is enclosed.</p>												
<p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p>												
<p>SEND ALL CORRESPONDENCE TO: G. Franklin Rothwell, Esq. Rothwell, Figg, Ernst & Kurz 555 13th St., N.W. Washington, D.C. 20004 Phone: 202/783-6040</p>												
 Signature <u>G. Franklin Rothwell</u> Name _____ _____ _____												
_____ _____ _____												

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2036-170
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of)
)
Jon TSCHUDI) **National Phase**
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) **PCT/NO98/00182**
Serial No. Unassigned) **Filed: June 12, 1998**
)
Filed: Concurrently Herewith) Examiner: Unassigned
)
For: METHOD AND APPARATUS) Art Unit: Unassigned
FOR MEASURING STRUCTURES)
IN A FINGERPRINT)

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Preliminary to examination of the subject application, please
amend the claims as follows:

In the claims:

Claim 3, line 1, delete "or 2".

Claim 4, line 1, delete "2, or 3".

Claim 5, line 1, delete "one of the preceding claims" and insert
--claim 4--.

Claim 9, line 1, delete "7 or 8,"

12. (Amended) Apparatus according to [any one of claims 6-] claim
11, characterized in that the sensors also comprises electrodes being
capable of measuring variations in the electric resistance along the
sensor array.

13. (Amended) Apparatus according to [any one of claims 6-] claim 12, characterized in that the sensors also comprises optical detectors, and preferably optical transmitters.

14. (Amended) Apparatus according to [any one of claims 6-] claim 13, characterized in that the sensor array is made from a semiconducting material, preferably silicon.

REMARKS

Claims 1-14 are pending in the application. The foregoing amendments to the claims are made at the outset merely to facilitate examination and put the claims in proper U.S. format. No new matter has been added. Entry is requested.

Respectfully submitted,

November 22, 1999

By



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09/404210

02 Rec'd PCT/PTO 22 NOV 1999

METHOD AND APPARATUS FOR MEASURING STRUCTURES IN A FINGERPRINT

The invention relates to a method and an apparatus for the measuring of structures in a fingerprint or the like, 5 comprising the measuring of chosen characteristics of the surface of the fingerprint, e.g. capacitance or resistivity, using a sensor array comprising a plurality of sensors, positioned in contact with, or close to, the surface.

Identification by the use of fingerprints has lately 10 come to the fore as a result of the increasing needs for security relating to, for example, credit cards or computer systems as well as the greatly increased availability of pattern recognition algorithms. Some systems for 15 recognition of fingerprints have already been made available on the market. The techniques used to register the finger- print varies.

Some of the previously known solutions are based upon 20 optical technology using light with one or more wavelengths. These are sensitive to dirt and contamination, both in the fingerprint and on the sensor surface, and thus cleaning is necessary for both.

Another alternative is pressure measurement, such as is described in US 5.559.504, US 5.503.029 and US 4.394.773. This, however, has the disadvantage that the sensor surface 25 becomes sensitive to mechanical wear and damage, as the sensor has to have an at least partially compliant surface.

Temperature sensors have also been suggested, for example in US patent 4,429,413 and international patent application PCT/NO96/00082.

30 Since fingerprint sensors may be exposed to long term use in varying and sometimes demanding conditions the sensor needs to have a robust surface and to be as insensitive to pollution in the fingerprint and on the sensor as possible. It must be capable of reading most fingerprints without 35 being disturbed by latent prints from earlier use. In some cases, e.g. in credit cards or computer keyboards, it would also be advantageous if the sensor could be made compact.

In the view of costs there is also a demand for simplicity and minimizing of the number of parts.

It is an object of the present invention to provide a sensor being easy to produce, making them cheap in production, and also relatively small.

In addition to the solutions mentioned above the measuring of capacitance has been tried as a method to measure finger prints. Examples are shown in US 4.353.056 and US 5.325.442. While the ridges of the fingerprint touches the sensor surface the valleys have a small distance to the sensor surface, resulting in a difference in capacitance and/or conduction measured at the different sensors. Humidity may affect the measurements, but if it is even throughout the fingerprint an analysis of the contrast between the measurements can provide a picture of it.

All the solutions mentioned above are based upon two-dimensional sensor arrays with dimensions comparable to the size of the fingerprint. These are expensive and difficult to produce, since they comprise a large number of sensors simultaneously measuring the surface.

EP 735.502 describes the use of a one or two-dimensional array of sensors being moved in relation to the finger print. The described solution is based on the measuring of resistance, and has a limited resolution defined by the minimum sensor dimensions and the distance between the sensors.

The present invention provides a method and an apparatus for the measuring of structures in a fingerprint or the like, for example using one of the techniques described above, characterized as stated in the disclosed claims 1 and 6.

As the surface of the sensor array is small, and contains few sensors compared to the known solutions, it is inexpensive and relatively simple to make. As the fingerprint to be measured is moved past the sensor array there is no latent fingerprint remaining from the previous user, giving another advantage in relation to the known finger print sensors.

Since the details in the fingerprints are small, it is also difficult to make the sensors of the detector small enough. In a preferred embodiment the apparatus and method according to the invention comprises two or more parallel

lines of measuring points, each line of measuring points being shifted in the longitudinal direction with a distance less than the distance between the measuring points, the sensor array comprising two or more parallel lines of
5 equally spaced sensors, preferably shifted in the longitudinal direction of the sensor array. This provides a possibility to measure structures in the fingerprint smaller than the spacing of the sensors. This is not possible with any of the previously known detector systems.

10 Thus, it is to be understood that the term "essentially one-dimensional array" here refers to an array having a length being much larger than its width, and may comprise more than one line of sensors.

15 The invention will be described below with reference to the enclosed drawings, which illustrate one possible embodiment of the invention.

Figures 1a and 1b shows a schematic view of two versions of the sensor.

20 Figure 2a illustrates the sensor in figure 1b in use, as seen from above.

Figure 2b shows a cross section of the situation in figure 2a.

Figure 3 shows a schematic view of an apparatus according to the invention.

25 Figure 4 shows a cross section of an embodiment of the invention.

Figure 5 shows a preferred embodiment of the invention.

In figure 1a a single, linear array of sensors 1 is shown. The sensors may be of different kinds, such as
30 pressure sensors or temperature sensors, but preferably they are electrical conductors providing a possibility to measure conduction, impedance or capacitance of the different parts of the fingerprint. The surface to be measured is moved in a perpendicular direction relative to the line of sensors.

35 In the preferred embodiment the sensors 1 are electrical conductors separated by an insulating material 3 such as epoxy. In the shown embodiment an electrically conducting material 2 surrounds the sensors which may be used to provide a reference potential. Thus the conduction,
40 impedance or capacitance, through the fingerprint, between

each of the sensors 1 and the surrounding reference level may be measured.

The shown embodiment having equally distanced sensors is preferred, but other solutions, e.g. comprising groups of 5 sensors for measuring certain parts of the finger print, is also possible.

Using one or more sensors positioned at one or more chosen distances from the sensor line will provide a possibility for measuring the velocity of the finger print 10 in relation to the sensor by comparing the signals from the sensor line and the time lapse or spacial shift between the measurements of corresponding structures in the surface.

Figure 1b shows a preferred embodiment of the invention in which the sensor array comprises two lines of sensors 1.

15 To be able to measure the structures in a fingerprint the array will typically be 10-15 mm long with a resolution of 50 μm . This is difficult or expensive to obtain using a single line of sensors. In figure 1b the lines are slightly shifted in relation to each other. When moving a surface 20 across the sensor array the measurements of each of the sensors in the second line will fall between the measured point of the first line, providing the required resolution with a larger distance between the sensors. Three or more lines are possible to improve the resolution even more, but 25 more than five would be impractical because of the distance between the lines and the resulting time lapse between the measurements of the first and the last line. Also, an apparatus using many lines would be sensitive to the direction in which the finger is moved.

30 Although the lines shown in the drawings comprise equally spaced sensors the shifted, second, third etc. lines may comprise single or groups of sensors, increasing the resolution in certain parts of the finger print, and/or measuring differences in velocity of different parts of the 35 finger print, in case the movements is uneven. Also, the second, third etc. lines may have an angle in relation to the first line of sensors.

When using a sensor array comprising two or more sensor lines, as shown in figure 1b, the measurements of the different lines must be combined to provide a signal corre-

DEPARTMENT OF DOCUMENTS

sponding to one single line of sensors. To do this the signals from the sensors must be adjusted for the time delay between the signals from the sensors in different lines, and thus the movement of the finger in relation to the sensor array must be known, either by moving the finger or sensor array with a chosen speed, or by measuring the movement of the finger.

Figure 2a illustrates how the finger 4 is moved over a sensor array in the direction perpendicular to the array. In order to obtain exact measurements the movement of the finger must be measured. In addition to the abovementioned method comprising the correlation of measurements from different sensors this may be done in many ways, such as providing a rotating cylinder in contact with the finger, so that the rotation of the cylinder may be measured. Another example may be the use of a thin disk on which the finger may be positioned, which is moved together with the finger and is connected to the apparatus so that the velocity of the disk may be measured. Preferably, however, the movement is measured by correlating or comparing the signals from the different sensor lines, and the time lapse or spacial shift between the measurements of corresponding structures in the surface is found. This way more detailed images can be made from the separate images of each line of sensors.

Another method for adjusting for the movement of the finger is to maintain the sampling rate at the sensor array, while adjusting the number of measured lines used in generating the segmented image of the surface, and thus the interval of the measurements according to movement in order to obtain at least one measurement of each portion of the surface. For example, if the fingerprint is moved slowly over the sensor, while the sampling or measuring frequency is high, the redundant data may simply be neglected and the image of the finger print is comprised by each second or third set of data.

Figure 2b shows a cross section of the finger 4 placed on the sensors 1, and also shows an exaggerated view of the ridges 5 and valleys 6 in the fingerprint.

Figure 3 shows a simplified view of the apparatus according to the invention comprising conductors 7 from the

sensors 1 to an amplifier and multiplexer 8. The signal is then digitized in an A/D-converter 9 before the digital signal is sent to a computer 10 comprising any available computer program being able to analyse the signal.

5 A cross section of a more realistic embodiment is shown in figure 4, in which one end of closely spaced conductors 11 represent the sensors, and the other end of these conductors are connected to a microchip. The conductors 11 may be a part of a multi layer printed circuit board moulded 10 in epoxy, producing two or more lines of sensors. Each sensor 1 would be about $35 \times 50 \mu\text{m}$. If the sensors in each line is mounted with distance between the centres of $150 \mu\text{m}$, the resolution with three shifted lines will be $50 \mu\text{m}$.

Figure 5 shows an embodiment of the invention where an 15 external time varying, e.g. oscillating or pulsating, voltage 12 is applied to the finger through the conducting area 14 on the side of the sensor area. Planes at a constant voltage 13 are placed close to and parallel to the conductors 11. This reduces cross-talk and noise from 20 external sources, and improves contrast in the image generated from the measurements. This may be implemented by using a multilayer printed circuit board, where one or more of the conducting layers are at a constant voltage. An insulating layer (not shown) preferably covers the 25 conductors 1,11 and shielding planes 13. The conducting area 14 may also be covered by an insulating layer, but this would decrease the signal strength. For better performance, the oscillating voltage 12 may be applied to both sides of the sensor surface. The oscillating voltage may, as 30 mentioned above, be a pulse train, or a sinus.

In one embodiment, a sinus of 100kHz is applied to the conducting area 14, and each of the conductors 11 is terminated by a resistance, and the signal is amplified and feed to a demodulator, multiplexer and analogue-to-digital 35 converter. One advantage of this embodiment is that there are essentially no signal on the conductors 11 in the sensor area when no finger is present, thus reducing problems with offset voltages varying with time and drift in the electronics.

40 This solution provides a sensor apparatus being simple

to produce using standard techniques, and thus cheap. It is also compact and rugged. If the measured parameter is the resistance the sensors, being the ends of the conductors, will not change their characteristics as they and the 5 surrounding epoxy are worn down. If the capacitance is to be measured a durable, insulating layer is provided on the sensors or conductor ends.

The preferred layout of the sensor also allows the resolution to be better than the distance between the 10 sensors, reducing cross-talk between the sensors.

The method and apparatus according to the invention may of course be utilized in many different ways, and different characteristics may be measured in order to provide a representation of the measured surface, in addition to 15 capacitance and/or conductivity. Optical detectors may be used, and preferably transmitters, so that the reflected image of the fingerprint may be analysed regarding for example contrast and/or colour.

The sensors may, as mentioned above simply be the ends 20 of conductors connected to means for measuring capacitance and/or conductivity, or may be sensors made from semi-conducting materials. A preferred semiconducting material when cost is essential would be silicon.

In the embodiment comprising capacitance measurements 25 an insulating layer (not shown) is provided between the conductor ends and the finger print.

Another possible embodiment within the scope of this invention comprises sensor lines of not equally spaced sensors positioned to measure chosen parts of the 30 fingerprint.

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A m e n d e d

C l a i m s

1. Method for the measuring of structures in a fingerprint or the like, comprising the measuring of chosen characteristics of the surface of the fingerprint using a sensor array comprising a plurality of sensors, being positioned in contact with, or close to, a portion of the surface,
- 5 comprising measuring of said characteristics in at least one line of measuring points along an elongated portion of the surface at given intervals of time, the sensor array being an essentially one-dimensional array,
- 10 measuring said characteristics using at least one measuring point being positioned at a chosen distance from said line of measuring points in a direction perpendicular to the axis of the line,
- 15 moving the surface in relation to the sensor array in a direction perpendicular to the sensor array, so that the measurements are performed at different, or partially overlapping, portions of the surface, and, from said
- 20 measurements at said line of sensors and said at least one sensor, calculating said movement,
- 25 combining the measurements of the measured portions of the surface to provide a segmented, two-dimensional representation of said characteristics of the surface.
- characterized in that the sensors are capacitive sensors separated from the surface with an insulating film said sensors being adapted to measure variations in the capacitance along the sensor array, and that a varying voltage is applied to the surface to be measured using an
- 30 electrode being placed separate from the sensor array.
2. Method according to claim 1,
characterized in that the measuring points of the array are essentially equally spaced along said essentially one-dimensional array.

3. Method according to claim 1 or 2,
characterized in the measuring of the relative
movement of the surface and adjusting the interval of the
measurements according to movement in order to obtain at
5 least one measurement of each portion of the surface.
4. Method according to claim 1, 2, or 3,
characterized in that each measurement of the
characteristics of an elongated portion of the surface
comprises essentially simultaneous measuring of said
10 characteristics along at least two lines of measuring
points, one of which comprising said at least one measuring
point,
each line of measuring points being shifted in the
longitudinal direction with a distance not equal to the
15 distance between the measuring points, the sensor array
comprising two or more essentially parallel lines of
essentially equally spaced sensors, preferably shifted in
the longitudinal direction of the sensor array.
5. Method according to one of the preceding claims,
20 characterized in that the movement is measured
by correlating the measurements from different measuring
lines in order to find the time lapse or spatial shift
between the similar structures at different lines of
measuring points.
- 25 6. Apparatus for measuring structures in a fingerprint or
the like, comprising a sensor array adapted to be positioned
close to, or in contact with, the surface of the
fingerprint, the sensor array being adapted to measure
chosen characteristics of the surface, e.g. by measuring
30 capacitance or resistivity, at a plurality of positions,
the sensor array being an essentially one-dimensional
array comprising at least one line of sensors, adapted to
measure said characteristics at chosen intervals of time,
the surface having a relative movement in relation to the
35 sensor array, with a direction essentially perpendicular to
the array,
and the apparatus comprises at least one sensor being

positioned at a chosen distance from said line of sensors in a direction perpendicular to said line,

and the apparatus comprising means for combining the measurements at the different time intervals to obtain a segmented, two-dimensional representation of the characteristics of the surface.

characterized in that the sensors are capacitive sensors adapted to measure variations in the capacitance along the sensor array,

and in that voltage supply means for applying a voltage varying with time to the surface to be measured are placed separate from the sensor array, and that a thin insulator separates the conductors in the sensor array from the surface to be measured, the sensors essentially measuring the capacitive coupling through the insulating layer, between the surface to be measured and the conductors.

7. Apparatus according to claim 6,

characterized in that the essentially one-dimensional sensor array comprises two or more parallel lines of essentially equally spaced sensors, said at least one sensor being comprised in said array.

8. Apparatus according to claim 7,

characterized that said sensor lines are shifted in the longitudinal direction of the sensor array with a distance not equal to the distance between the sensors.

9. Apparatus according to claim 6, 7 or 8,

characterized in that the apparatus comprises a device for finding the movement of the surface in relation to the sensor array.

30 10. Apparatus according to claim 9,

characterized in that the device comprises means for comparing the signals from the different lines of sensors to find the time lapse or spacial shift between the similar structures at the different sensor lines.

11. Apparatus according to claim 6,
characterized in that the conductors in the
sensor array are placed essentially normal to the surface to
be measured, and that one or more planes of constant voltage
5 are placed close to and parallel to the conductors,
extending essentially to the insulating layer.
12. Apparatus according to any one of claims 6-11,
characterized in that the sensors also comprises
electrodes being capable of measuring variations in the
10 electric resistance along the sensor array.
13. Apparatus according to any one of claims 6-12,
characterized in that the sensors also comprises
optical detectors, and preferably optical transmitters.
14. Apparatus according to any one of claims 6-13,
15 characterized in that the sensor array is made
from a semiconducting material, preferably silicon.

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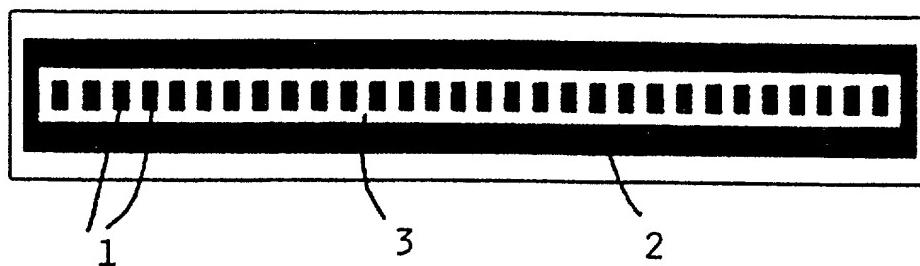


FIG. 1A

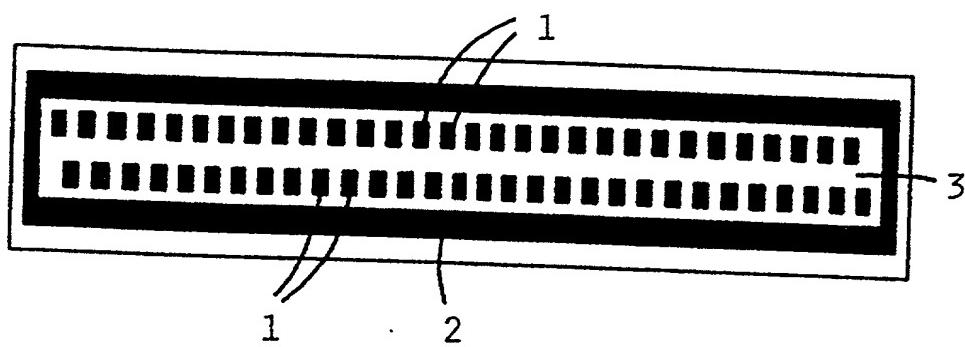


FIG. 1B

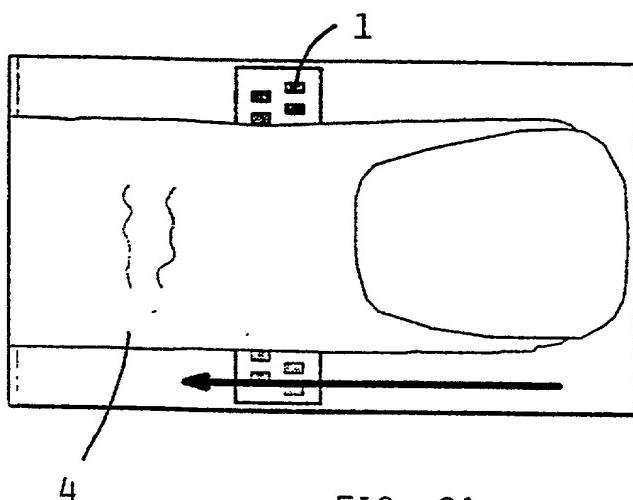


FIG. 2A

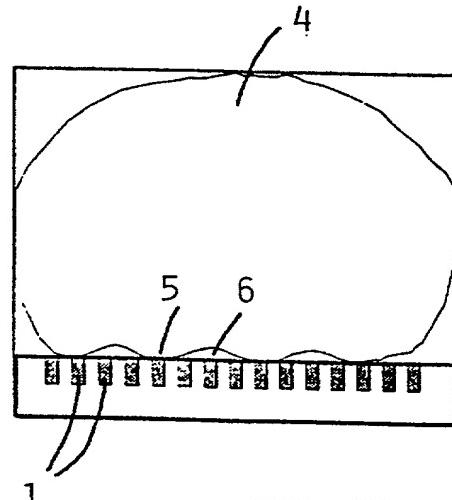


FIG. 2B

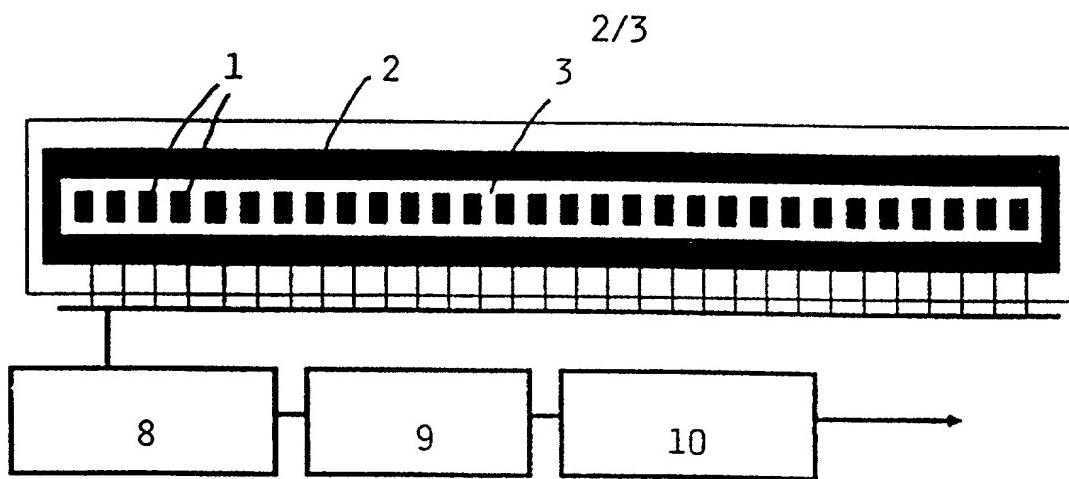


FIG. 3

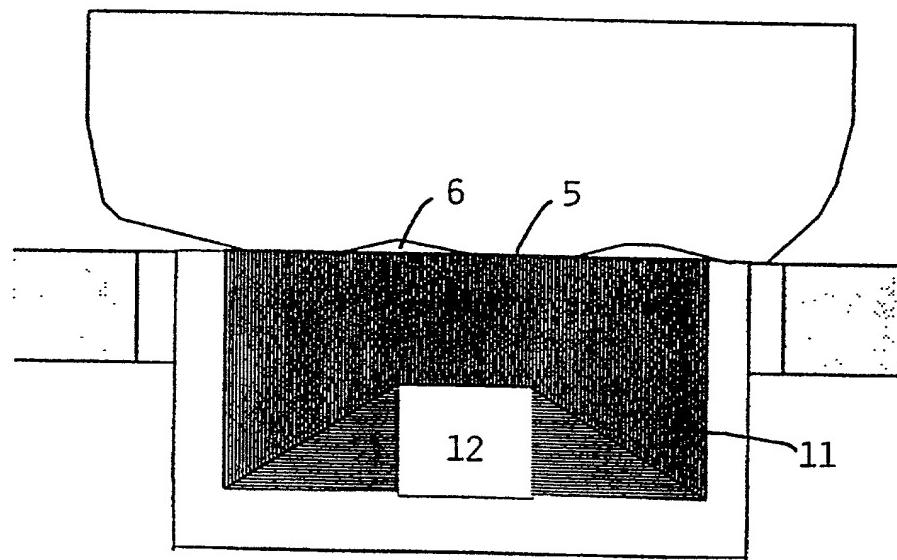


FIG. 4

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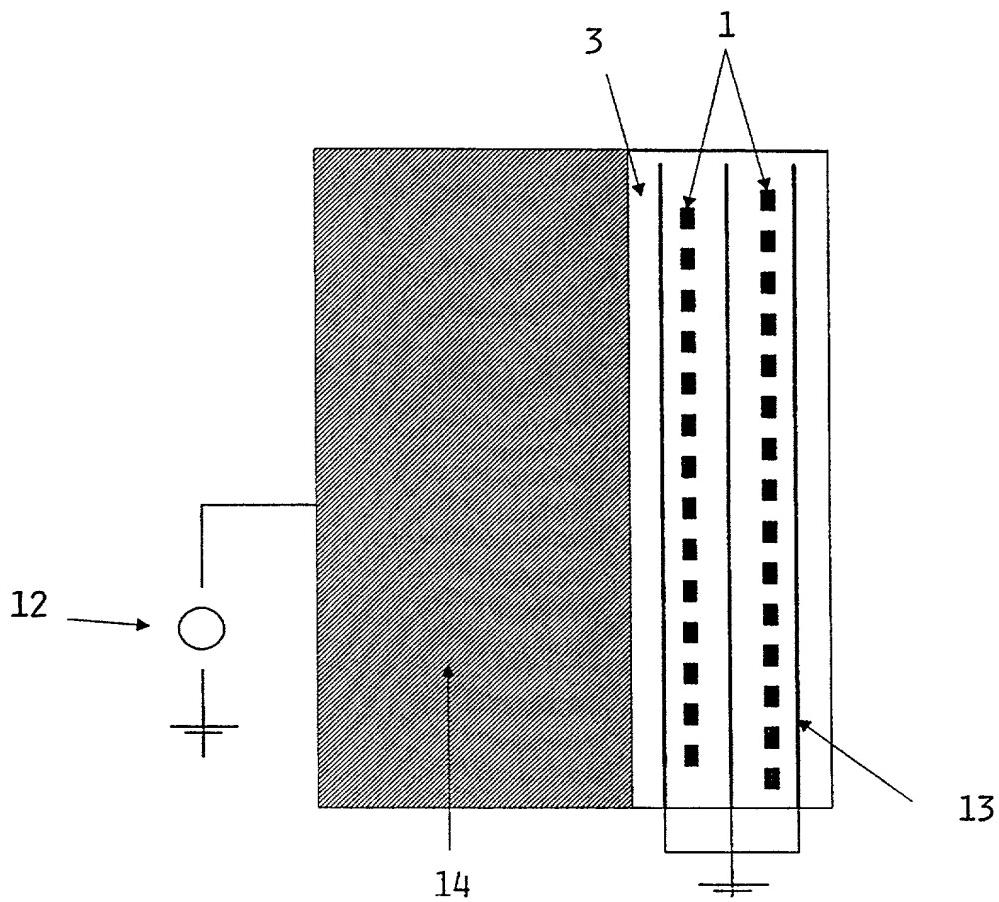


FIG. 5

**Declaration and Power of Attorney
For Patent Application
(Sole/Joint)**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought, on the invention entitled METHOD AND APPARATUS FOR MEASURING STRUCTURES IN A FINGERPRINT

the specification of which *(Check One)*

_____ is attached hereto.

X was filed on 12 June 1998 as
[] Application Serial No. _____
[X] International Application No. PCT/NO98/00182
and was amended on _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

			Priority Claimed
<u>972759</u> (Number)	<u>Norway</u> (Country)	<u>16 June 1997</u> (Day/Month/Year Filed)	Yes: <u>X</u> No: _____
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	Yes: _____ No: _____
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	Yes: _____ No: _____

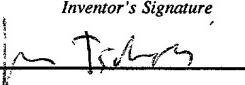
I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose

material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)	(Filing Date)	(Status)
(Application Serial No.)	(Filing Date)	(Status)
I or we hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to ROTHWELL, FIGG, ERNST & KURZ, P.C., 555 13th Street, N.W., Washington, D.C. 20004		

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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